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Received for publication 28 December 1993; revised and accepted 10 April 1994.

Journal of the Lepidopterists' Society
48(4), 1994, 386-388

HOST PLANTS OF *POANES MELANE* (HESPERIIDAE)

Additional key words: grasses, Poaceae, skipper, biology.

Poanes melane (Edwards), the umber skipper [formerly *Paratrytone melane* (Burns 1992)], is found along the Coastal Range of California and in the foothills of the Sierra Nevada. In rural areas adults are found in grassy habitats along streams and in forests (Emmel & Emmel 1973). This species is common in urban and suburban areas, most likely because its host plants (grasses; Poaceae) are abundant and well-maintained in lawns (Heppner 1972, Brown 1984). This source of host plants could become especially important during the summer generation, a dry season in California when many grasses are no longer green. *Poanes melane* larvae are known to feed on several C₃ and C₄ grasses, including *Cynodon dactylon* (L.) Pers. (C₄), *Deschampsia caespitosa* (L.) Beauv. (C₃), *Lamarckia aurea* L. (Moench) (C₃), and *Stenotaphrum secundatum* Kuntze (C₄), and one sedge (Cyperaceae), *Carex spissa* Bailey (Brown 1984, Scott 1986).

Adult female *P. melane* lay eggs singly on the undersurfaces of grass blades. The mature larva is approximately 30 mm long with a brown head and dusky yellow-green or tan body mottled with black punctations of varying sizes (Comstock & Dammers 1931, Emmel & Emmel 1973). Larvae have a blackish mid-dorsal line, a cream lateral stripe, and three dark lines on each side (Scott 1976). Larvae also construct tubular shelters by tying two or more leaves of their host plants together with silk or by rolling single broad leaves into tubes secured with silk along their edges. Mature larvae feed nocturnally, generally at the distal ends of tied or rolled leaves. This association between shelter formation and feeding activity was used in several cases in this study to determine the use of host plants by *P. melane*. I report here several new host records from Berkeley, California made during a four year study of the relative performance of *P. melane* larvae on C₃ and C₄ grasses. All plants used in feeding experiments were grown from seed available commercially or from the U.S. Department of Agriculture Soil Conservation Service, unless otherwise noted.

Poanes melane larvae were observed feeding on a hedge of bamboo, *Phyllostachys bambusoides* Sieb. and Zucc. (Poaceae, C₃), for three generations in 1985 and 1986. Complete development to adults was inferred from the presence of pupal cases in larval shelters. Oviposition by adults on *P. bambusoides* was observed on several occasions in the field.

Ehrharta erecta Lam. (Poaceae, C₃) is commonly used by larvae in the field (observed from 1985 to 1989). In laboratory experiments, *P. melane* grew well on *E. erecta* grown from seed collected in the field (Barbehenn and Bernays 1992). Oviposition was observed on several occasions on *E. erecta* in the field.

Late-instar larvae were observed feeding on *Lolium multiflorum* Lam. (Poaceae, C₃) on two occasions in 1985. Adult *P. melane* (one male and one female) were reared from these larvae. *Lolium multiflorum* also supported growth to adulthood in laboratory experiments (Barbehenn and Bernays 1992), and adults in 0.5 m³ cages readily oviposited on potted plants. However, in two subsequent years larvae fed one-month-old *L. multiflorum* commonly rejected it or were unable to grow.

Poanes melane larvae (n=4) were collected on *Paspalum dilatatum* Poir. (Poaceae, C₄) in March 1985 (Elizabeth Bernays pers. comm.). Larvae were successfully reared on *Paspalum dilatatum* in several laboratory experiments (Barbehenn and Bernays 1992).

Pennisetum clandestinum Hochst. ex Chiov. (Poaceae, C₄) was commonly oviposited on in the field. In the laboratory this coarse grass supported good larval growth (Barbehenn and Bernays 1992). *Pennisetum clandestinum* was grown from plants collected in the field.

Sorghum sudanense (Piper) Stapf. (Poaceae, C₄), planted in a mixed stand with *C. dactylon*, *P. clandestinum*, and *E. erecta*, was commonly oviposited on by adults flying in a 13×7×3 m outdoor screen cage in 1986 and 1987. Larvae grew rapidly on *S. sudanense* in laboratory experiments (Barbehenn and Bernays 1992).

One case was observed in February 1987 of a mature larva feeding on *Hordeum leporinum* (Link) (Poaceae, C₃). Later efforts to rear *P. melane* on this species were unsuccessful, however. Fourth-instar larvae commonly rejected *H. leporinum* leaves from plants grown from seed collected in the field.

Digitaria sanguinalis (L.) Scop. (Poaceae, C₄) was found to be an acceptable host plant, both for oviposition in the laboratory and for larval growth (Herbert Baker pers. comm.). The source of these plants was not determined.

Scott's (1986) listing of *Bromus carinatus* as a host plant of *P. melane* is based on a field observation by John Lane of oviposition on this species (Langston 1980). Two additional records reported here confirm that *B. carinatus* is used by *P. melane* adults and larvae. Several mature larvae were found on this species in March 1985 (Junji Hamai pers. comm.) and a female was observed ovipositing on *B. carinatus* in the Berkeley Hills in May 1985 (John Brown pers. comm.).

In addition to the above observations of host use by *P. melane*, the ability of larvae to use several novel grass species was tested. Larvae were reared on *C. dactylon* through three instars and then fed the following grasses during the fourth instar: *Dactylis glomerata* L. (potted plants from the field), *Agrostis palustris* Huds., *Festuca myuros* L., *Festuca rubra* L., and *Agropyron cristatum* (L.) (all C₃ Poaceae). Larvae were successfully reared on each of these species (Barbehenn and Bernays 1992). Finally, *Poa pratensis* (L.) (Poaceae, C₃) was readily accepted by larvae, but it was not determined whether larvae develop successfully on this species.

In addition to certain plantings of *L. multiflorum* and *H. leporinum*, three grasses were found to be unsuitable as hosts for *P. melane*: *Panicum virgatum* (L.), *Panicum amarulum* (Hitch. & Chase), and a native coastal grass *Muhlenbergia rigens* (Benth.) Hitch. (all C₄ Poaceae). Larvae (n = 3 per species) consistently rejected the *Panicum* species. *Muhlenbergia rigens* was readily accepted by larvae (n = 15) but did not support growth. The unusually tough and thick leaves of *M. rigens* is a possible factor limiting its use by *P. melane*.

With the exception of *D. caespitosa* and *B. carinatus*, all of the grasses previously reported as host plants for *P. melane* are introduced species. In addition, all of the new host plants reported here are introduced species. As noted by Brown (1984), few native host plants of *P. melane* are known. Given the acceptability of a wide variety of grasses as host plants, it seems likely that *P. melane* originally fed on a variety of native grasses before the spread of introduced grasses in California. The acceptability of a wide variety of grasses by *P. melane* also suggests that the "indiscriminate" oviposition on grasses by captive females (Comstock & Dammers 1931) and a free-flying female (Brown 1984) may represent a viable egg-laying strategy.

Support for this work was provided by NSF grant BSR-8701000 to E. A. Bernays and R. V. Barbehenn. C. Don MacNeill and John W. Brown provided helpful information on *P. melane*. I thank C. Don MacNeill and James A. Scott for critical comments on the manuscript.

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Received for publication 10 December 1993; revised and accepted 25 June 1994.

Journal of the Lepidopterists' Society
48(4), 1994, 388-393

COMMENTS ON THE NATURE AND ORIGINS OF MIGRATIONS OF LEPIDOPTERA TO BERMUDA

Additional key words: evolution, migratory cues.

"The Lepidoptera of Bermuda" (Ferguson, Hilburn & Wright 1991), which I recently reviewed for this Journal (Gaskin 1993), includes an interesting essay in the Appendix which, for brevity, I refer to below as Ferguson (1991). In this, he discussed a number of problems and paradoxes concerning the nature and origins of the long-distance migrations of Lepidoptera to Bermuda, stimulating the additional thoughts and comments presented in this note.

I will start by summarizing the general findings of Ferguson et al. (1991): Bermuda is an oceanic archipelago, dominated by one large island, that caps a seamount with no earlier geological connections to the North American mainland. This archipelago supports a disparate, super-saturated lepidopterous fauna, assembled by over-water dispersal at various times during the last five hundred thousand years, from southeastern North America and the northeastern Caribbean. A small number of endemic species are recognized, derived from ancestors in these two regions. The remaining members of the Bermudian fauna are morphologically and probably genetically, similar to their source populations.

The biomass, diversity, and composition of the Bermudian fauna must have undergone dramatic increases and reductions during the Quaternary concomitant with several radical fluctuations in the surface area of the archipelago.

It was not the primary purpose of Ferguson and his co-workers to develop hypotheses concerning the role that interactions of environmental stimuli, physiology, and behavior might have played in the evolution of long distance migrations of Lepidoptera to Bermuda. Certainly, the phenomenon appears to pose problems for the evolutionary geneticist. If there is no demonstrable return flight, then there seems to be no way for the trait to be fed back into the source population, and no cumulative selection from one generation to the next (Ehrlich 1984). Some of the Lepidoptera which migrate frequently to Bermuda have near-global ranges, and are found also on other oceanic islands. Others have close relatives in widely distant regions with similar migratory behavior. Ferguson estimates